

Jan. 31, 1967

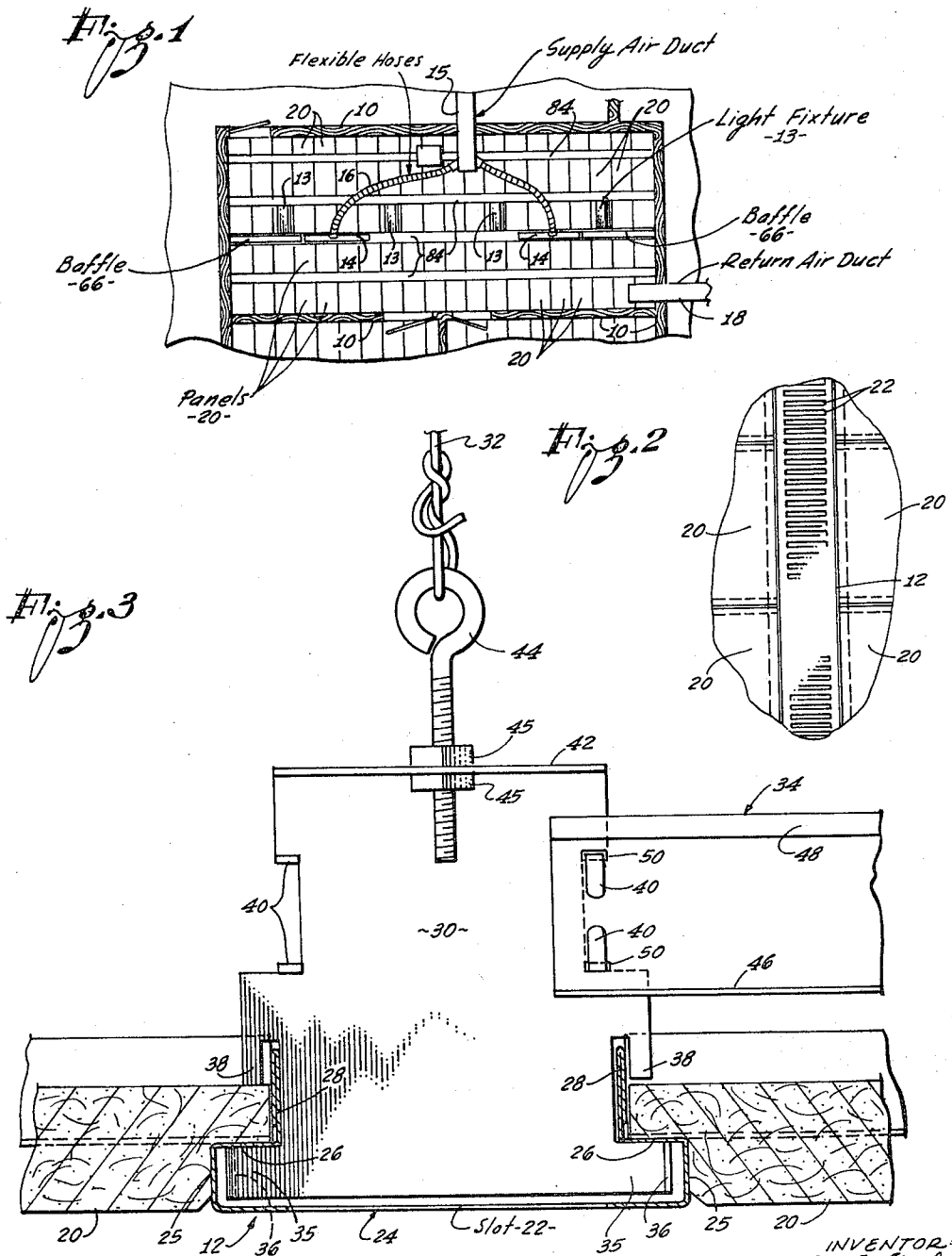
J. E. STANLEY

3,301,165

CEILING AIR CONDITIONING SYSTEM

Original Filed Oct. 26, 1964

4 Sheets-Sheet 1



INVENTOR:
John E. Stanley

By Amyth, Roston & Parrott
Attorneys

Jan. 31, 1967

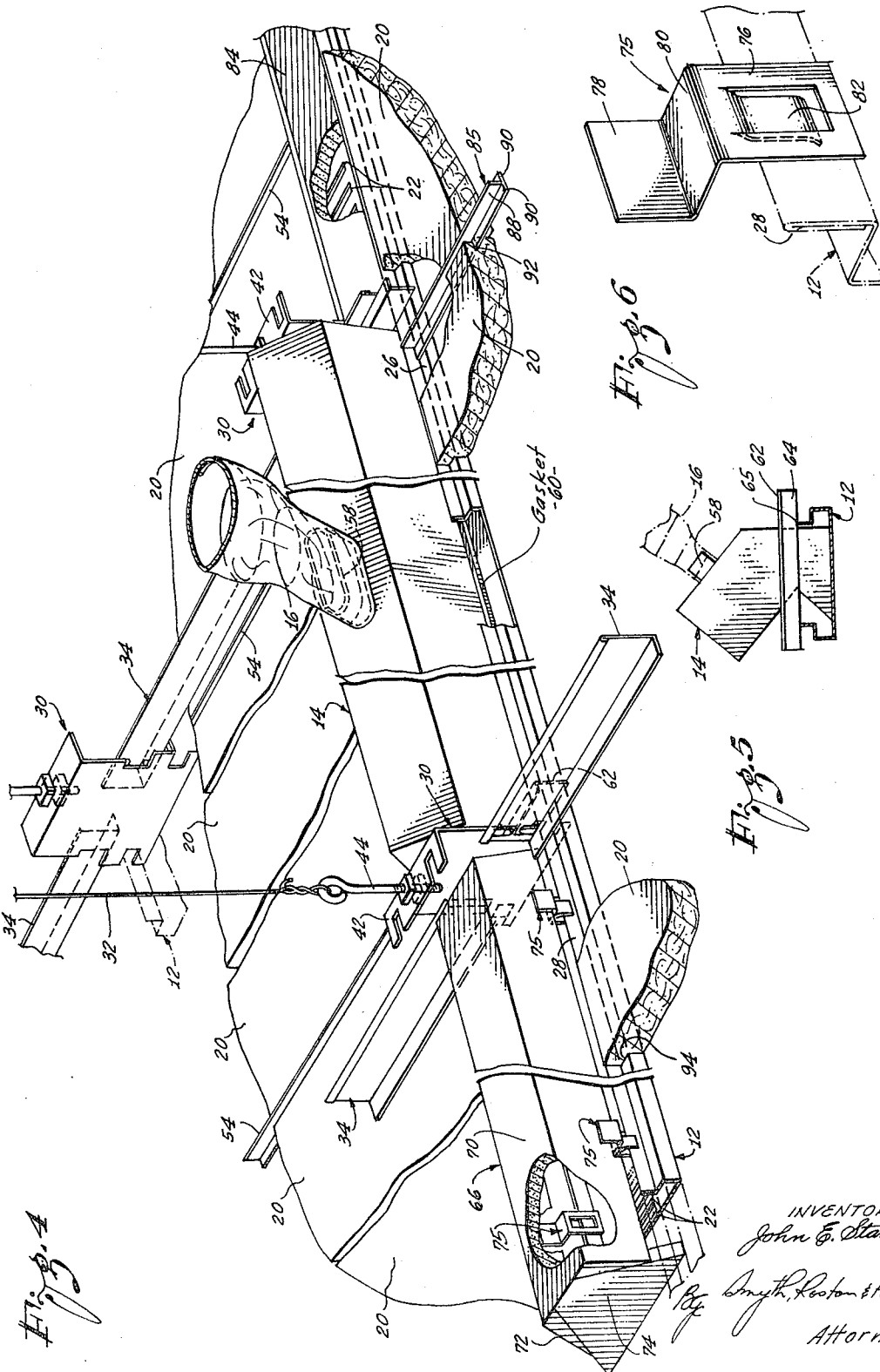
J. E. STANLEY

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CEILING AIR CONDITIONING SYSTEM

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INVENTOR:
John E. Stanley
By Smith, Kooten & Parrott
Attorneys

Jan. 31, 1967

J. E. STANLEY

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Fig. 7

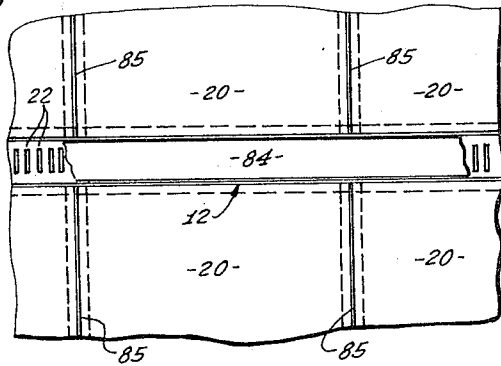


Fig. 8

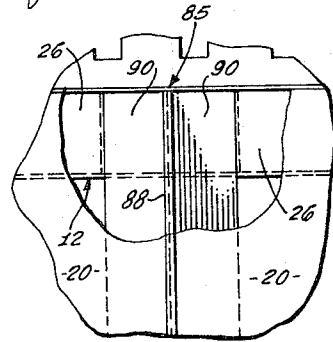


Fig. 9

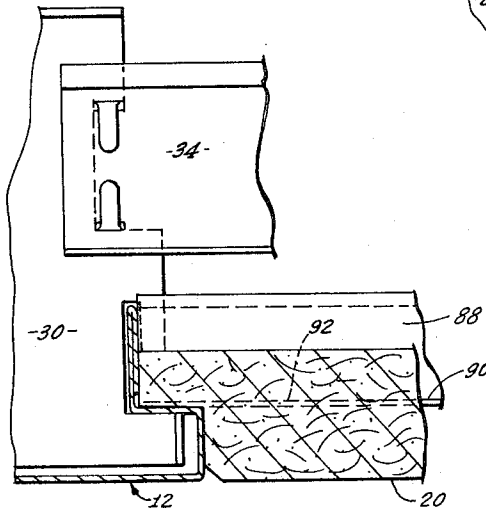


Fig. 10

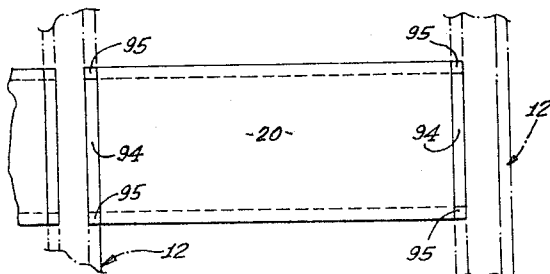
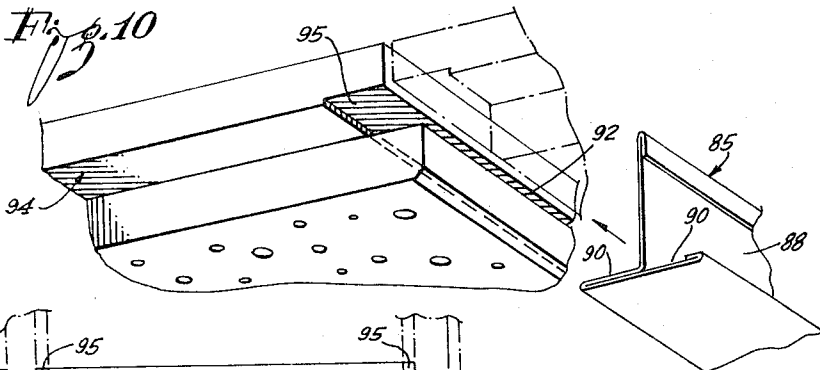


Fig. 11

INVENTOR
John E. Stanley
By: Smyth, Roston & Pavitt
Attorneys

Jan. 31, 1967

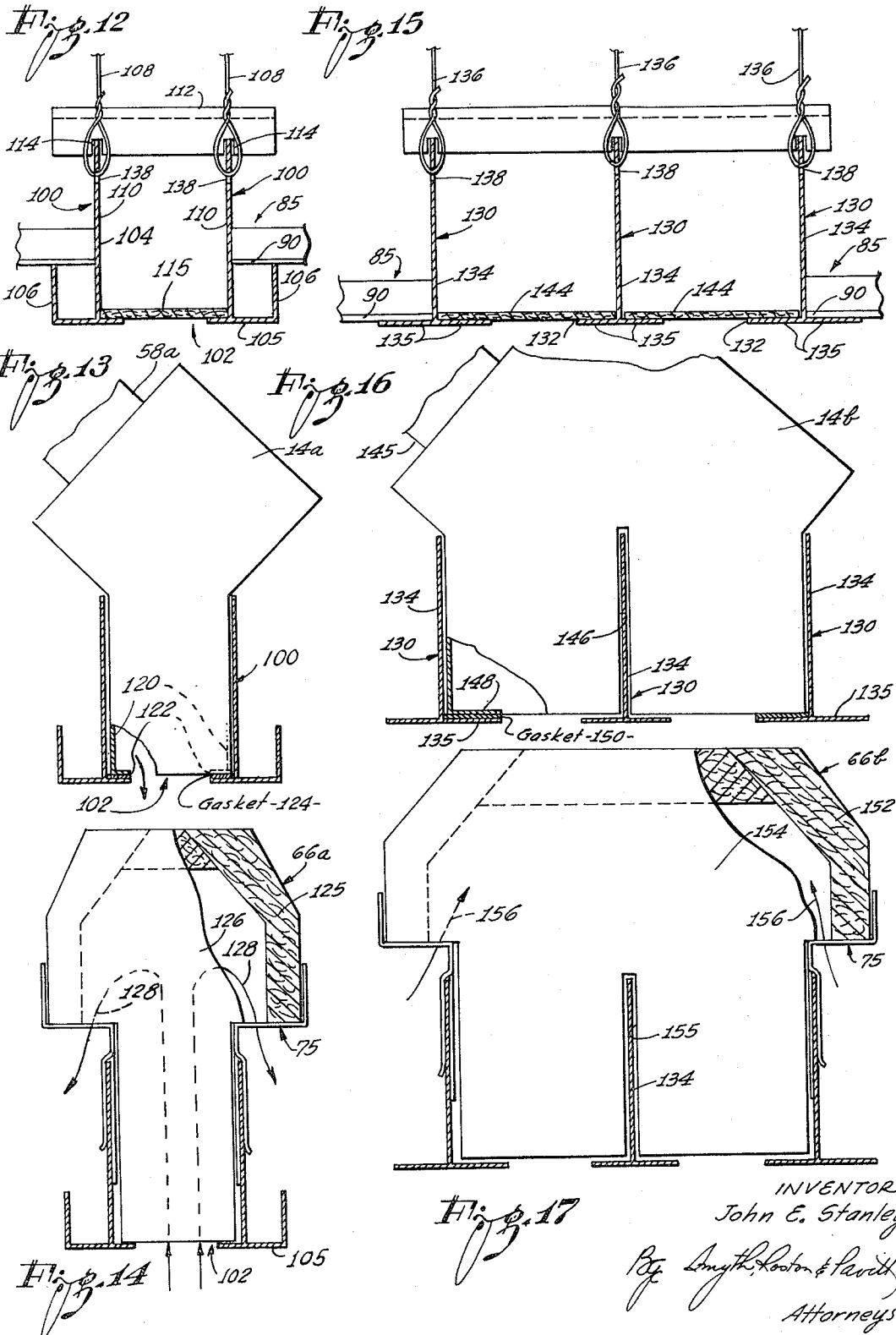
J. E. STANLEY

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CEILING AIR CONDITIONING SYSTEM

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3,301,165

CEILING AIR CONDITIONING SYSTEM

John E. Stanley, Flintridge, Calif., assignor to Duo-Flex Corporation, Glendale, Calif., a corporation of California

Continuation of abandoned application Ser. No. 407,951, Oct. 26, 1964. This application June 3, 1966, Ser. No. 555,206

12 Claims. (Cl. 98—40)

This application is a continuation of my copending application Serial No. 407,951, filed October 26, 1964, and now abandoned, which in turn was a continuation-in-part of my co-pending application No. 325,636, filed November 22, 1963, and now abandoned.

This invention relates to acoustical ceilings incorporating ventilation means for supplying fresh air to room spaces and is directed to meeting certain problems that are involved in the construction of such ceilings.

One of the problems is to incorporate in such a ceiling suitable openings to diffuse fresh air into room spaces as well as suitable openings for return air flow. Another problem is to provide such openings in a decorative and unobtrusive manner in contrast to the conspicuous appearance of conventional rectangular registers in a ceiling. Still another problem is to achieve economy by a ceiling construction made up of relatively inexpensive components that may be quickly and easily assembled without highly specialized skill.

A further pressing problem of primary importance is to provide an acoustical ceiling of this character that is highly flexible not only in the sense of affording free choice in the initial arrangement of the ventilation components but also in the sense of freely permitting rearrangement of the ventilation components at minimum expense to meet changes in ventilation requirements. Where an acoustical ceiling structure extends over a number of room spaces, each provided with an adequate supply of fresh air, the need may arise to shift partitions to change the room spaces, and, of course, the ventilation system must be changed accordingly. Or the requirement may be simply to change the location of air ingress or egress in one of the room spaces because of a change in desk location or to suit the comfort of a particular occupant. In a conventional ceiling structure such changes in the ventilation system are major structural operations that cause inconveniences to occupants in addition to being expensive.

The present invention meets all of these problems by a suspended ceiling construction in which a portion of the ceiling surface is provided by spaced parallel primary ceiling support members in the form of panels that are of open construction in that they are perforated or slotted uniformly in some pleasing manner to serve as means for inflow and outflow of air. In the preferred practice of the invention the multiple purpose panels are channel members with upturned overhanging flanges and the panels are suspended from the overhead structure of the building by means of wires and sheet metal hangers, the hangers engaging the overhanging flanges of the panels.

Air is supplied to the room spaces by hollow units or box-like enclosures with open bottoms that conform to the elongated configuration of the open panels. These hollow units are mounted on the upper sides of longitudinal portions of open panels in a conveniently removable manner to use the openings of the panels for delivering fresh air into the room spaces and thereby cooperate with the panels to serve as supply air plenums. To make the hollow units freely movable and removable, at least one relatively large supply air duct extends into the space above the ceiling and the supply duct is connected to a plurality of the hollow units by corresponding suitable highly flexible connector ducts.

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The space above the suspended ceiling serves as a return air plenum chamber and for this purpose communicates with a suitable relatively large return air duct. Longitudinal portions of the open ceiling panels are left open for return air flow from the room spaces into the return air plenum chamber. The remaining longitudinal portions of the open panels are closed by suitable masking strips. The exposed undersides of the open panels are of pleasing uniform appearance with no visual indications whatsoever of the different portions that are used for supply air and return air, and the portions that are simply blanked off.

Usually some provision is required to minimize the transmission of sounds from one room space to another through the supply air plenum chamber above the ceiling and for this purpose suitable baffles may be associated with the portions of the open panels that are used for return air flow. In this regard a feature of the preferred practice of the invention is the provision of attenuation baffles in the form of inverted troughs of sound-absorbing material that extend along the open portions of the open panels. The troughs are supported by the panels but are spaced slightly above the open bottoms of the panels to provide clearance for return air flow.

In the preferred practice of the invention, the ceiling is demountable in the sense that any of the acoustical tiles may be readily removed for access to the space or return air plenum chamber above the ceiling. For this purpose, as will be explained, the opposite ends of the individual acoustical tiles rest on longitudinal shoulders of the open panels so that any one of the tiles may be simply lifted upward to afford access to the space above the ceiling. Light fixtures for the ceiling are mounted in the same manner with the opposite ends of the light fixtures resting on longitudinal shoulders of the open panels. Thus, the light fixtures and the acoustical tiles are interchangeable to make it a simple matter to shift a light fixture from one location to another.

The flexibility of such a ceiling structure may be readily appreciated. The magnitude of the air supplied to a room space may be selected by selecting the longitudinal dimension of a box-like hollow unit for the room space or by using an appropriate number of hollow units of a given size. In like manner, the capacity for return air flow from the room space may be chosen by simply leaving open the required portion of the open panel or panels with appropriate attenuation baffles above the open portions. The flexible connector ducts afford freedom in the location of the hollow units and, of course, there is nothing to interfere with a choice of location of the attenuation panels for return air flow.

In installing such a ceiling, decisions as to specific locations and specific sizes of the ventilation components as well as the location of the light fixtures may be left to the last minute for the convenience of occupants. Once the installation is completed, moreover, changes in the ventilation components and the light fixtures may be made quickly, conveniently and at a minimum expense. A flexible connector duct leading from a supply duct to a hollow unit permits ready relocation of the hollow unit within the length of the flexible connector duct. Such a flexible connector duct may be readily disconnected from a hollow unit to permit one hollow unit to be substituted for another and, if desired, a relatively long flexible connector duct may be substituted for a relatively short flexible connector duct to permit a desired change in location of a hollow unit.

A further feature of the preferred practice of the invention is the manner in which each of the readily demountable acoustical tiles is shaped and dimensioned for substantially airtight engagement with the longitudinal shoulders of the perforated panels as well as with the

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associated T-splines that are employed at the junctures of the successive tiles. As will be explained, the acoustical tiles are so shaped as to make the ceiling substantially airtight without the necessity of employing the usual antibreathing splines along the longitudinal shoulders of the perforated panels.

The features and advantages of the invention may be understood from the following detailed description and the accompanying drawings.

In the drawings, which are to be regarded as merely illustrative:

FIG. 1 is a fragmentary schematic view showing how both a supply duct and a return air duct extend into the plenum air chamber above the ceiling and also showing how both a supply duct and a return air duct extend into the plenum air chamber above the ceiling and also showing how individual hollow units are connected to the supply duct by flexible connector ducts;

FIG. 2 is a fragmentary bottom plan view of the ceiling showing how a perforated support panel forms a portion of the ceiling surface;

FIG. 3 is a greatly enlarged fragmentary sectional view showing how a perforated support panel is suspended from overhead building structure;

FIG. 4 is a fragmentary perspective view of a portion of the upper side of the ceiling structure;

FIG. 5 is an end elevation of a hollow unit mounted in a perforated support channel;

FIG. 6 is a perspective view on an enlarged scale showing the construction of a clip that may be employed to support an attenuation baffle above an open portion of a perforated support panel;

FIG. 7 is a fragmentary plan view of the ceiling structure as seen from the space above the ceiling;

FIG. 8 is an enlarged fragment of FIG. 7;

FIG. 9 is a fragmentary view similar to FIG. 3;

FIG. 10 is a perspective view showing how a tile is shaped to cooperate both with a T-spline and with a longitudinal shoulder of a perforated panel;

FIG. 11 is a bottom plan view showing how a single acoustical tile rests at its opposite ends on longitudinal shoulders of two spaced perforated panels;

FIG. 12 is a cross section of a primary support panel of open construction that may be employed in another practice of the invention, the panel being characterized by a single longitudinal slot instead of a plurality of perforations;

FIG. 13 is a similar view showing a hollow unit mounted on the longitudinal slotted support member;

FIG. 14 is a similar view showing an attenuation baffle mounted on the slotted support panel;

FIG. 15 is a view similar to FIG. 12 illustrating another panel of open construction that may be employed, the panel providing a pair of parallel longitudinal slots for the passage of air flow therethrough;

FIG. 16 is a view similar to FIG. 15 showing a hollow unit mounted on the slotted panel of FIG. 15; and

FIG. 17 is a similar view showing how an attenuation baffle may be mounted on the slotted panel of FIG. 15.

FIG. 1 shows schematically how room spaces may be defined by partitions 10 with the room spaces covered by a ceiling structure which includes a plurality of spaced parallel primary support members in the form of perforated support panels 12. The ceiling structure is made up largely of acoustical tiles 20 which are not shown in detail in FIG. 1 and the ceiling structure incorporates light fixtures 13.

In FIG. 1 a plurality of box-like hollow units 14 are arranged at spaced locations along the perforated support panel 12 with the individual hollow units connected to a relatively large supply air duct 15 by corresponding flexible connector ducts 16. The space above the ceiling structure serves as an air plenum chamber which is connected to a relatively large return air duct 18.

FIG. 2 shows how the major portion of the exposed

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undersurface of the ceiling structure is formed by conventional acoustical tile members 20 with a minor portion of the ceiling surface provided by the perforated underside of at least one support panel 12. The perforations in the support panel 12 may be of any suitable configuration and of any suitable pattern of distribution. In this instance the perforations are spaced parallel transversely slots 22.

As best shown in FIG. 3, each of the panels 12 that serve as primary support members for the ceiling structure is of the general configuration of a channel member. Thus each panel 12 has a bottom web 24 that forms a portion of the ceiling surface and is provided with the laterally extending slots 22. The panel has a pair of upwardly extending longitudinal side flanges 25 each of which is offset to form a longitudinal shoulder 26 and an upwardly extending inner flange 28. The sheet metal is bent back on itself to give the two inner flanges 28 double thickness for increased strength.

Although the perforated support panels 12 may be suspended in any suitable manner from the overhead building structure, in this instance, the panels are supported by means of special hanger members 30 which engage the panels and which are suspended from the overhead building structure by suitable wires 32. As shown in FIG. 4 the hanger members 30 may be arranged in rows and interconnected by spacer members in the form of L bars 34 formed of sheet metal. Thus with the perforated panels 12 arranged in parallel relationship and interconnected by the spacer bars 34 in cooperation with the hanger members 30 the result is a rigid support grid for the acoustical tile members 20.

Each of the hanger members 30 may comprise a piece of pliable sheet metal cut and bent to the configuration shown in FIG. 3. The upright piece of sheet metal fits into a perforated panel 12 transversely thereof and is formed with a pair of opposite side ears 35 that engage the previously mentioned shoulders 26 from below. Each of the two side ears 35 has a flange 36 at its outer edge and these two flanges are turned in opposite directions. The sheet metal of a hanger member 30 is further formed with a pair of opposite locking tabs 38 that are initially bent to horizontal positions. In addition the opposite side edges of the sheet metal of a hanger member 30 is formed with a pair of spaced tongues 40 that also are initially bent to horizontal position as shown on the left side of FIG. 3. Finally the upper end of the sheet metal is bent to form a top flange 42 to receive a hanger bolt 44 for connection to a wire 32, the hanger bolt being anchored to the hanger member by a pair of opposed nuts 45.

To install a hanger member 30 in the ceiling structure, the hanger member is inserted into the interior of a perforated panel 12 and then is rotated to its transverse assembled position shown in FIG. 3. The two locking tabs 38 are then turned downward to the positions shown in FIG. 3 where they overhang the two inner flanges 28 of the panel to prevent any degree of rotation of the hanger member that would result in disengagement of the hanger member from the panel.

Each of the L bars 34 that serves as a spacer member between two hanger members 30, may be made of light sheet metal with a lower longitudinal flange 46 and with the metal bent back on itself to form a reinforcement bead 48 on the upper edge of the bar. Each of the L bars 34 is formed with a pair of apertures 50 in each of its ends to receive a pair of the tongues 40 of a hanger member. To attach an L bar 34 to a hanger member 30, a pair of the horizontal tongues 40 of the hanger member are inserted through the pair of apertures 50 and then the tongues are bent towards each other as shown at the right in FIG. 3.

Each of the hollow units 14 may be a box-like enclosure with an open bottom, the enclosure being of elongated dimension to fit into a perforated panel 12 be-

tween the two side flanges 28 of the panel. Such a hollow unit may be of any length up to a length equal to the distance between two of the hanger members 30. In a large room space several of the hollow units 14 may be used, for example as indicated in FIG. 1.

In the construction shown in FIGS. 4 and 5 a hollow unit 14 is of polygonal cross sectional configuration as indicated and is formed with a suitably shaped nipple 58 to telescope into the end of a flexible connector duct 16. The connector ducts 16 may be made of highly flexible plastic material.

Each of the hollow units 14 rests on the bottom web 24 of a perforated panel 12 with a suitable gasket 60 interposed to make the juncture substantially airtight. Each of the hollow units 14 is stabilized and prevented from turning over by transverse angle members 62 that are respectively firmly attached to its two opposite ends. As indicated in FIG. 4 each of the two angle members 62 has a downwardly extending longitudinal flange 64 which is formed with a pair of slots 65 which straddle the edges of the two inner flanges 28 of the perforated panel without taking the weight of the hollow unit off the bottom web 24 of the panel.

FIG. 4 shows how a combined air return and attenuation baffle, generally designated 66, may be mounted over a longitudinal portion of a perforated panel 12 where the longitudinal portion of the panel is open for return air flow from the room space below to the plenum chamber above the ceiling. The baffle 66 is of elongated configuration to conform to the configuration of the perforated panel 12 and may be of any length up to the full distance between two of the hanger members 30. In FIG. 4, the baffle 66 is made of relatively thick plates of suitable sound-deadening material i.e. sound-attenuating material, for example, a fibrous material having a decibel ratio of 25 to 60 in an attenuation loss test. The baffle is fabricated with a top wall 70 and two divergent side walls 72, the baffle being open on its under side. In FIG. 4 one end of the baffle 66 is both closed and supported by a trapezoidal end wall 74 that rests inside the panel 12 and the other end of the baffle is closed by backing against a hanger member 30. In some instances the baffle 66 will be dimensioned to abut against hanger members 30 at both of its ends, the two hanger members serving as two end walls for the baffle.

If a baffle 66 needs to be supported by additional means, suitable clips may be employed for this purpose, for example clips 75 of the construction that is best shown in FIG. 6. Each clip 75 is a piece of rectangular sheet metal bent to angular configuration to form a downwardly extending flange 76 and upwardly extending flange 78 and an intermediate support shoulder 80. The material of the downward flange 76 is lanced and bent to form an offset tongue 82 to permit the clip to be mounted on one side of a perforated panel 12 by straddling an inner flange 28 of the panel in the manner shown in FIG. 4.

FIG. 4 shows how the clips 76 may be used along each side of a baffle 66 with the lower edges of the side walls 72 of the baffle resting on the support shoulders 80 of the clips. The clips 75 hold the lower edges of the baffle 66 spaced above the inner flanges 28 of the perforated panel by a distance to provide clearance of the same flow capacity as the perforations or slots 22 of the panel 12.

All of the longitudinal portions of the perforated panels 12 that are not occupied either by a hollow unit 14 or an attenuation baffle 66 are sealed off by suitable masking strips such as the masking strip 84 shown in FIG. 4. The masking strip 84 may be a fixed slab of the previously mentioned sound-deadening material i.e. sound-attenuating material, that is dimensioned to cover the apertures or transverse slots 22 of the panel, the strip fitting snugly between the two inner flanges 28 of the panel. Preferably the lower faces of the masking strips 84 are painted black so that the perforations or slots 22 in the region of a masking strip have the same appearance as the slots in

the region of either a hollow unit 14 or an attenuation baffle 66.

As shown in FIG. 4 a T-spline 85 of a well known type extends along the juncture of each pair of successive acoustical tiles 20 of the ceiling. Each T-spline 85 has a longitudinal vertical web 88 and two opposite side flanges 90. As shown in both FIG. 4 and FIG. 8, each end of a T-spline 85 rests on a longitudinal shoulder 26 of a perforated panel 12 with the two side flanges 90 of the T-spline resting flat on the longitudinal shoulder. A T-spline 85 supports the corresponding longitudinal sides of the adjacent acoustical tiles 20 and for this purpose the longitudinal sides of the tiles are formed with kerfs 92 that receive the side flanges of the T-splines. As may be seen in FIGS. 4 and 10, each end of each of the acoustical tiles 20 is cut away to provide an overhanging lip 94 to rest on the longitudinal shoulder 26 of the corresponding perforated panel 12.

It is to be especially noted in FIG. 10 that the underside of a overhanging lip 94 is provided with a notch or shallow recess 95 at each end of the lip to provide clearance for the corresponding side flange 90 of a T-spline 85. The depth of the shallow recess 95 is substantially the same as the depth of an adjacent kerf 92 and the surface of the recess is an extension of a surface of the kerf 92 in the same plane as the kerf surface.

It is apparent that with this configuration the lip 94 at each end of each acoustical tile 20 not only makes airtight contact with the flanges 90 of the two associated T-splines 85 but also makes airtight contact with the longitudinal shoulder 26 of the perforated panel 12 that lies between the two T-splines. Thus with the longitudinal kerfs 92 of the tile making airtight engagement with the T-splines, each acoustical tile is substantially airtight along its entire periphery. The feature of this construction is that it eliminates the flat strips or anti-breathing splines that are usually employed as spacers on the longitudinal shoulders 26 between successive T-splines.

The manner in which the invention serves its purpose may be readily understood from the foregoing description. It may be appreciated that it is a simple matter to place one or more hollow units 14 in perforated panels 12 for a given room space with the hollow units connected by flexible connector ducts 16 to the supply air duct 15. It is also a simple matter to provide one or more combined air return and attenuation baffles 66 in one or more perforated panels in the room space to provide adequate capacity for return air flow from the room space into the plenum chamber above the acoustical ceiling. It is an exceedingly simple matter to install masking strips 84 to seal off all of the perforations or transverse slots 22 of the panels that are not required for the air conditioning of a room space. Since the acoustical tiles 20 are interchangeable with the light fixtures 13 there is complete freedom with respect to the locating of the light fixtures. Even at the last minute in the installation of the air conditioning components, the air conditioning components and the light fixtures may be shifted at will with considerable freedom. It is obvious no critical dimensions are involved in the relationships between the perforated panels and the various components comprising the hollow units 14, the attenuation baffles 66 and the masking strips 84.

It is further apparent that it is an exceedingly simple matter to rearrange the components of the airconditioning system and the light fixtures in the event that partitions are moved to vary the room spaces.

In this regard it is important to note that access to the space above the ceiling may be provided in any area of the ceiling by simply lifting the acoustical tiles out of their normal positions of rest on the longitudinal shoulders 26 of the perforated support panels 12. The T-splines that interconnect the side edges of the acoustical tiles are lifted with the tiles and permit angular movement of the tiles relative to each other.

A feature of the invention is the omission of the usual anti-breathing splines along the longitudinal shoulders 26. If a portion of a conventional acoustical ceiling is partially dismantled for access to the space above the ceiling, the anti-breathing splines become a nuisance since care is required to manipulate the splines back into their normal positions when the portion of the ceiling structure is re-assembled.

In FIG. 1 it is apparent the two flexible connector ducts 16 are so long that the corresponding hollow units 14 may be freely shifted over large areas. If it is necessary to substitute one flexible connector duct 16 for another to provide a greater range of freedom, it is a simple matter to disconnect the connector duct for replacement. It is such a simple matter to change the location of the air conditioning components that a change may be quickly made where a desk in a room space is changed from one location to another or an occupant would be more comfortable if the location of a supply air plenum were changed. In the same manner the light fixtures may be shifted at will.

FIGS. 12, 13 and 14 show how a pair of closely spaced parallel structural beams, each generally designated 100, defined a longitudinal slot 102 and may be substituted for a previously described perforated support panel 12. Each of the two beams 100 is essentially of the shape of an inverted T with a longitudinal vertical web 110, a bottom horizontal web 105 and a relatively low upright longitudinal side flange 106 along one edge of the bottom web 105. Each of the two beams 100 is supported from overhead building structure by a plurality of wires 108 each of which is looped through an aperture 138 in the vertical web 104.

The two beams 100 of each pair are mechanically interconnected by a series of spacers 112 which in this instance are light meal angle irons with notches 114 in their flanges, each notch straddling the upper edge of a longitudinal web 110. Thus with a series of spacers 112 mechanically interconnecting the two beams 100 of each pair of beams, it is apparent that each of the pairs of beams constitutes in effect a single longitudinally slotted support panel within the meaning of the term as used in the appended claims.

The purpose of the longitudinal side flanges 106 are to support the ends of the previously mentioned T splines 85, the side flanges 90 of which engage the kerfs of acoustical tiles.

Since each pair of the beams 100 provides a longitudinal slot 102 for air flow through the plane of ceiling, it is further apparent that a support panel that is constituted by each pair of beams is of open construction in the same sense that the previously described perforated support panel 12 is of open construction. In any region where a longitudinal slot 102 formed by a pair of beams 100 is not employed for air flow through the plane of the ceiling, a suitable masking strip 115 is mounted on the upper surface of the bottom webs 105 of the two beams to cut off air flow through the slot. The masking strip is confined along its two longitudinal edges by the two vertical webs 104 of the two beams 100.

FIG. 13 shows how a hollow unit 14a may be employed in the same general manner as a previously described hollow unit 14. The supply air plenum 14a has a usual nipple 58a for connection to the usual flexible connector duct (not shown). The hollow unit 14a is of closed box-like construction with inwardly turned longitudinal bottom flanges 120 that rest on the bottom longitudinal webs 105 of the pair of the beams 100. The two longitudinal flanges 120 of the hollow unit 14a define a slot 122 which registers with the longitudinal slot 102 that is defined by the two beams 100. In the usual manner the juncture between the hollow unit 14a and the bottom webs 105 of the two beams 100 is sealed by gasket strips 124.

FIG. 14 shows how a combined air return and at-

tenuation baffle 66a of the same general character as the previously described attenuation baffle 66 may be mounted on a pair of the beams 100. The attenuation baffle 66a includes an elongated hood 125 made of relatively thick plates of suitable sound-deadening fibrous material, the two ends of the hood being closed by two end walls 126. As shown in FIG. 14 each of the end walls 126 extends downward between the two beams 100 to block endwise flow into the attenuation baffle. The hood portion of the attenuation baffle rests on a plurality of previously described clips 75 with the sides of the hood spaced from the two beams 100 to provide spaces for air to flow into the interior of the hood as indicated by the arrows 128.

It is to be noted that to a person looking up at the ceiling, the longitudinal slots 102 formed by the various pairs of beams 100 appear to be uniformly dark. The slots appear to be uniformly dark because the interior of the hollow units 14a and the interiors of the combined air return and attenuation baffles 66a are dark and because the undersides of the masking strips 115 are of matching dark hue.

FIGS. 15 to 17 illustrate another embodiment of the invention in which a set of three closely spaced parallel beams 130 constitute in effect a single longitudinal support panel having two spaced parallel longitudinal slots 132.

Each of the three beams generally designated 130, is of a configuration of an inverted T having a vertical longitudinal web 134 and a lower horizontal web which forms two opposite longitudinal side flanges 135. In a completed ceiling some marginal portions of acoustical tiles rest on the side flanges 135 and other marginal portions of acoustical tiles rest on the side flanges 90 of T splines 85, with the ends of the T-splines resting on side flanges 135 of the beams 130. The beams 130 are suspended from overhead building structure by suitable wires 135 which are looped through apertures 138 in the vertical webs 134. The three beams 130 of each set are fixedly spaced apart in the previously described manner by spacers 140 in the form of angle members having suitable slots 142 to straddle the upper edges of the three beams. Where the two parallel longitudinal slots 132 of a set of the beams 130 are not employed for air flow through the plane of the ceiling, suitable masking strips 144 are employed in the manner heretofore described.

FIG. 16 shows how a hollow unit 14b may be employed with a set of three beams 130 in the manner heretofore described. The hollow unit 14b is of a closed box-like construction of the character heretofore described and is provided with the usual nipple 145 for connection to a flexible connector duct (not shown). The hollow unit 14b nests between the vertical webs 134 of the two outermost beams 130 and each of the two end walls of the hollow unit is formed with a vertical slot 146 to clear the vertical web 134 of the intermediate beam 130. The hollow unit 14b is formed with inwardly turned bottom flanges 148 which rest on gasket strips 150.

FIG. 17 shows how a combined air return and attenuation baffle, generally designated 66b, may be employed with a set of the three beams 130. Here again the combined air return and attenuation baffle 66b comprises an elongated hood 152 made of thick plates of fibrous sound-deadening material, the two ends of the hood being closed by end walls 154. Each of the two opposite end walls 154 extends downward between the vertical webs 134 of the two outermost beams and is formed with a vertical slot 155 to clear the vertical web 134 of the intermediate beam. The hood 152 rests on a plurality of clips 75 as heretofore described with the hood spaced from the two outermost beams 130 to provide spaces for inward air flow as indicated by the dotted arrows 156.

My description in specific detail of the selected embodiments of the invention will suggest various changes,

substitutions and other departures from my disclosure within the spirit and scope of the appended claims.

What is claimed is:

1. A ceiling structure for an air conditioning system in a building, said structure comprising:

a dropped transverse ceiling spaced from the ceiling of a floor of the building, to form a plenum chamber between the floor ceiling and the dropped ceiling, said dropped ceiling including at least one elongated panel having a transverse bottom of open construction to permit air flow therethrough in either direction;

first and second air duct means extending into the plenum chamber, one of said first and second duct means being connected to a source of air-conditioned air under pressure, and the other one of said first and second duct means providing a return air flow passage;

at least one hollow box-shaped unit, said unit being disposed on a portion of, and supported by, said panel, and, with said panel, forming a hollow box having a top, two sidewalls, two end walls and an open transverse bottom wall;

one of said first and second air duct means being in air flow communication with the interior of said unit through an opening therein above said transverse bottom wall;

at least one masking member seated on another portion of said panel thereby to prevent air flow through the open areas of the transverse bottom of said other portion of the panel; and

at least one additional portion of the transverse bottom of said panel being left uncovered by both said unit and said masking member, and in air flow communication with said plenum chamber.

2. The ceiling structure as described in claim 1 in which the box-shaped unit and masking member are removably disposed on their respective portions of the said panel, thereby enabling them to be moved to different portions of the panel.

3. A ceiling structure for use with an air conditioning system in a building having room spaces defined by vertical partitions, said structure comprising:

a dropped transverse ceiling spaced from the ceiling of a floor of the building and in abutment with the upper edges of the vertical partitions,

said dropped ceiling with the floor ceiling defining a plenum chamber;

said dropped ceiling further including a plurality of horizontal main support members each of which support members has a transverse bottom of open construction to permit air flow therethrough in either direction;

said dropped ceiling further including a plurality of acoustical tiles supported by said main support members;

first and second air duct means extending into the plenum chamber, one of said first and second duct means being connected to a source of air-conditioned air under pressure, and the other one of said first and second duct means providing a return air flow passage;

a plurality of hollow box-shaped units, each of said units being disposed on a portion of, and supported by, one of said main support members, and with such member, forming a hollow box having a top, two side walls, two end walls and an open transverse bottom wall; one of said first and second air duct means being in air flow communication with the interior of each said unit through an opening therein above its transverse bottom wall;

a plurality of masking members seated on some other portions of said main support members to prevent air flow through the open areas of the transverse bottoms of such other portions of such members; and

additional portions of the transverse bottoms of said main support members being left uncovered by both any said unit and any said masking member, and hence in air flow communication with said plenum chamber;

said units and said masking members being movable from the respective portions of the support members on which they are disposed to other portions of such panel members, thereby to permit redistribution of the air intakes and air outlets to said room spaces in said building.

4. The ceiling structure as defined in claim 1 in which the masking members are made of sound-attenuating material.

5. The ceiling structure as defined in claim 3 in which the main support members have perforate horizontal bottom walls to secure the upper edges of the partitions thereto.

6. The ceiling structure as defined in claim 3 in which the acoustical tiles are supported flushly with the transverse bottoms of said main support members.

7. The ceiling structure as defined in claim 1 in which sound attenuating baffles are provided and supported above and spaced from the additional uncovered portions of the transverse bottom of said panel, said baffles being relocatable to conform with any shifting of the said uncovered portions.

8. The ceiling structure as defined in claim 7 in which the said baffles are of the configuration of an inverted trough with flared sides.

9. In an acoustical ceiling construction in a building structure, the combination of:

a plurality of acoustical tiles providing the major portion of the ceiling surface with space above the tiles to serve as a return air plenum chamber;

spaced elongated panels serving as primary support members for the tiles, each of the panels being formed with longitudinal upstanding flanges on its opposite sides, the bottom of each panel being of open construction for air flow therethrough;

supply air duct means extending into the return air plenum chamber;

at least one elongated hollow unit shaped and dimensioned to conform to the interior of a panel between the upstanding flanges of the panel, the hollow unit being connected to the supply air duct means and being mounted on a longitudinal portion of a panel between the upstanding flanges thereof with the open bottom of the longitudinal portion serving as the air outlet of the hollow unit,

other longitudinal portions of the panels having their bottoms open to the return air plenum chamber for return air flow thereto;

transverse extending means fixedly attached to each end of the hollow unit and engaging the upstanding flanges of the panel to stabilize the hollow unit; and a plurality of masking members resting on and closing the open bottoms of remaining portions of the panels, said hollow unit and masking members being interchangeable to permit change of location of the open bottom portions of the panels that accommodate supply air flow and the open bottom portions of the panels that accommodate return air flow.

10. In an acoustical ceiling construction in a building structure, the combination of:

a plurality of acoustical tiles providing the major portion of the ceiling surface, with space above the tiles to serve as a plenum chamber,

spaced elongated panels serving as primary support members for the tiles, the bottom faces of the panels providing a minor portion of the ceiling surface, the bottoms of the panels being of open construction for air flow therethrough;

supply air duct means in the plenum chamber;

a plurality of elongated hollow units, each open on

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its underside and shaped and dimensioned to conform to a panel, each of the hollow units being mounted over a longitudinal portion of a panel to form therewith a supply air plenum with the open bottom of the longitudinal portion serving as the air outlet of the supply air plenum, 5

other longitudinal portions of the perforated panels having their bottoms open to the plenum chamber for return air flow thereto;

a corresponding plurality of connector ducts connecting the supply air duct means in the plenum chamber to the individual hollow units, said ducts being flexible to permit change of location of the individual hollow units; 10

a plurality of masking members resting on and closing the open bottoms of remaining portions of the panels, said hollow units and masking members being interchangeably movable for change of location of the portions of the panels that accommodate supply air flow and the portions of the panels that accommodate return air flow; 15

baffles of sound-absorbing material extending over said other longitudinal portions of the panels; and means to support said baffles levels above the corresponding longitudinal portions of the perforated panels to place the open bottoms of said other portions of the panels in flow communication with the plenum air chamber, 20

said panels having upwardly extending horizontal flanges and said baffles being supported by pluralities of clips straddling the upstanding flanges of the support members. 25

11. A combination set forth in claim 10 in which each of said clips has a shoulder for supporting the baffle and a downwardly extending flange, the downwardly extending flange being cut and bent to form a downwardly extending tongue for engagement with the upstanding flange of a panel.

12. In an acoustical ceiling of the character described, the combination of: 30

spaced primary support members having longitudinal shoulders on their opposite sides; 35

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secondary support members in the form of T-splines each formed with a vertical web and opposite longitudinal flanges at the lower edge of the vertical web, the T-splines spanning the spaces between the successive primary support members with the opposite ends of the T-splines resting on the longitudinal shoulders of the primary support members and with the opposite longitudinal flanges of the T-splines resting flat on the longitudinal shoulders; and 40

rows of acoustical tiles spanning the spaces between the successive primary support members, the tiles being formed with overhanging lips on their opposite ends resting on the longitudinal shoulders of the primary support members, the tiles being formed with longitudinal kerfs in their opposite sides in engagement with the longitudinal flanges of the T-splines,

each of the overhanging lips of each of the acoustical tiles being recessed at its opposite ends to conform to the cross-sectional configuration of the longitudinal flanges of the T-splines that extend along the opposite side edges of the tile whereby the overhanging lips of the tile make substantially airtight contact both with the longitudinal flanges of the T-splines and with the surfaces of the longitudinal shoulders of the primary support members between the T-splines.

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40 ROBERT A. O'LEARY, *Primary Examiner*.
W. WAYNER, *Assistant Examiner*.

Disclaimer

3,301,165.—*John E. Stanley*, Flintridge, Calif. CEILING AIR CONDITIONING SYSTEM. Patent dated Jan. 31, 1967. Disclaimer filed June 30, 1969, by the assignee, *Duo-Flex Corporation*.

Hereby enters this disclaimer to claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11 of said patent.

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